

ABSTRACT

Pneumatic muscles capable of delivering bi-directional forces are described having an actuator with a tube or bladder surrounded by a braided material mounted in parallel with a resilient spring. When the bladder is pressurized with a pneumatic source, it expands and its length contracts. During the contraction cycle, the resilient spring is compressed and stores energy until subsequently released, which corresponds when the pressure in the bladder is released. As the spring expands, it produces an expansion force. The contraction and expansion forces are controllable using a number of configurations, including changing the equilibrium position of the resilient spring, using a different rated bladder, and using different initial pressure.